Vol. 81, pp. 403–412 30 August 1968

PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTON

HELMINTH PARASITES OF ANTARCTIC VERTEBRATES. PART IV. MONOGENETIC TREMATODES FROM ANTARCTIC FISHES: THE SUPERFAMILY CAPSALOIDEA PRICE, 1936[1]

By William J. Hargis, Jr. and William Arthur Dillon[2]
Virginia Institute of Marine Science
Gloucester Point, Virginia

This paper on the Monogenea (Carus, 1863) is the fourth in a series dealing with certain trematodes from fishes of Antarctic waters. It treats three species belonging to the superfamily Capsaloidea Price, 1936. The scope, organization, and purpose are the same as for Part II of this series (Hargis and Dillon, in press).

Materials and Methods: Methods involved in the preservation and the preparation of the Monogenea for identification and study are essentially the same as those given by Dillon and Hargis (1965).

All measurements were made with the use of a calibrated filar micrometer and are given in microns unless otherwise noted. In indicating these measurements the mean is given, followed by the range (minimum and maximum) in parentheses. The standard deviation (S), standard error ($S_{\bar{x}}$), and the interval estimate at the 95% level ($t_{.05}S_{\bar{x}}$) follow the range. For convenience the alphabetical symbols SE and CL are utilized for the formal mathematical designations for standard error ($S_{\bar{x}}$) and

[1] This entire research is supported by grants GA-13853, with amendments, and GA-235 under the United States Antarctic Research Program of the National Science Foundation, to whom our thanks are due. The writers also wish to thank the following individuals for their valuable contributions to this study: Dr. Willis L. Tressler for the initial collection from Wilkes; Messrs. W. Stanley Wilson and William J. Saunders, formerly of the Parasitology Section of the Virginia Institute of Marine Science, for the collection of host materials from McMurdo and Wilkes; Dr. Harry L. Holloway of Roanoke College for the collection of additional specimens from McMurdo; Dr. Hugh DeWitt and Dr. Donald E. Wohlschlag for the identification of host fishes.

Contribution No. 275 from the Virginia Institute of Marine Science, Gloucester Point, Virginia.

[2] Present address: University of Southern Mississippi, Southern Station, Box 1631, Hattiesburg, Mississippi 39401.

confidence limits or interval estimate at the 95% level ($t_{.05}S_{\bar{x}}$), respectively. The number of measurements used in the calculations appears in parentheses before these data. Measurements of curved structures were made across lines subtending the greatest arcs described by those structures. In the measurements to follow, length—of the body, its appendages and most internal organs—refers to the distance along the anteroposterior axis except where otherwise noted. Width refers to a measurement made at right angles to the length, i.e., along the dextrosinistral axis. The measurements of the lengths of cirri, genital ducts, anchors and hooks were made along the longest axes of those structures regardless of orientation.

Camera lucida drawings were used to facilitate identification and in the preparation of the figures.

Station Locations: In general, collections at McMurdo Station were made in nearby McMurdo Sound from shore or ice while those at Wilkes Station were made in the waters around the Windmill Island group through ice or from the Institute's specially built research vessel, R/V *Octans*. Actual locations are given immediately below for greater precision since the area is not widely known and the habitats from which hosts were collected ranged from shelf to oceanic. The first letter in each station number gives the base of operations (M = NAF McMurdo; W = Wilkes Station), and the second letter (and sometimes a third letter) gives the collecting locality. The station designation is followed by: (1) general locality, and (2) precise location of each sampling station. For trapping stations, latitude and longitude are presented. Beginning as well as ending positions are provided for trawl runs. Also presented are: (1) date of sampling, (2) type of sampling gear used, (3) depth in fathoms at sampling location (if the sampling was done over a straight course, the depth range is given) and, (4) a general description of the nature of the bottom where known.

Station M-SA: McMurdo Sound. 77° 42′ S, 166° 15′ E. October 1959 to February 1960. Trap. Depth 150 fathoms.

Station M-SC: McMurdo Sound. 77° 48′ S, 166° 30′ E. October 1959 to February 1960. Trap. Depth 300 fathoms.

Station M-M: McMurdo Sound. 77° 51′ S, 166° 38′ E. October 1959 to February 1960. Trap. Depth 5 fathoms.

Station M-H: McMurdo Sound. 77° 55′ S, 166° 39′ E. During 1964–1965.

Station W-BA: Ramp Cove. 66° 17′ S, 110° 32′ E. 12 January 1958. Hook and line. Depth 2.5–3.3 fathoms.

Station W-C: Windmill Islands. 66° 16′ 00″ S, 110° 31′ 00″ E to 66° 16′ 00″ S, 110° 31′ 34″ E. 25 January 1961. Trawl. Depth 30–50 fathoms. Rock.

Station W-G: Windmill Islands. 66° 14′ 25″ S, 110° 27′ 40″ E to 66° 14′ 40″ S, 110° 28′ 25″ E. 13 February 1961. Trawl. Depth 25–35 fathoms. Rock.

Station W-H: Windmill Islands. 66° 14′ 05″ S, 110° 27′ 30″ E to

66° 14′ 20″ S, 110° 28′ 15″ E. 13 February 1961. Trawl. Depth 25–35 fathoms.

Station W-I: Windmill Islands. 66° 13′ 12″ S, 110° 27′ 45″ E to 66° 13′ 30″ S, 110° 28′ 25″ E. 22 February 1961. Trawl. Depth 20–30 fathoms. Rock.

Station W-J: Windmill Islands. 66° 15′ 59″ S, 110° 32′ 17″ E. 10 March 1961. Trap. Depth 20 fathoms.

Station W-K: Windmill Islands. 66° 15′ 52″ S, 110° 34′ 26″ E. 12 March 1961. Trap. Depth 10 fathoms.

Station W-L: Windmill Islands. 66° 15′ 55″ S, 110° 34′ 50″ E. 16 March 1961. Trap. Depth 12 fathoms.

Station W-M: Windmill Islands. 66° 15′ 56″ S, 110° 35′ 05″ E. 2–3 June 1961. Trap. Depth 9 fathoms.

Station W-O: Windmill Islands. 66° 15′ 50″ S, 110° 35′ 01″ E. 1–3 September 1961. Trap. Depth 7 fathoms.

Station W-P: Windmill Islands. 66° 15′ 54″ S, 110° 35′ 01″ E. 5 September 1961. Trap. Depth 6 fathoms. Sand–rock.

Station W-Q: Windmill Islands. 66° 15′ 58″ S, 110° 33′ 43″ E. 6 September 1961. Trap. Depth 33 fathoms. Rock.

Station W-R: Windmill Islands. 66° 20′ 41″ S, 110° 27′ 52″ E. 11 October 1961. Trap. Depth 98 fathoms.

Station W-S: Windmill Islands. 66° 20′ 59″ S, 110° 26′ 59″ E. 2 December 1961. Trap. Depth 200 fathoms. Mud.

Station W-AO: Windmill Islands. 66° 14′ 20″ S, 110° 34′ 06″ E to 66° 14′ 16″ S, 110° 34′ 14″ E. 15 December 1961. Trawl. Depth 1–6 fathoms. Mud–rock.

ORDER MONOGENEA CARUS, 1863

Suborder Monopisthocotylea Odhner, 1912

SUPERFAMILY CAPSALOIDEA PRICE, 1936

Family Capsalidae Baird, 1853

Subfamily Trochopodinae (Price, 1936) Sproston, 1946

Discussion: The subfamily Trochopodinae was reviewed in a previous paper (Dillon and Hargis, 1965, p. 241–243). Since that review we have concluded that Bychowsky (1957) and Dollfus and Euzet (1964) were correct in transferring *Pseudobenedenia* Johnston, 1931 from Benedeniinae Johnston, 1931 to this subfamily. Also, recent studies indicate that the genus *Trochopella* Euzet and Trilles, 1962 is similar in every taxonomically important feature to *Trochopus* Diesing, 1850 as characterized by Yamaguti (1963). Therefore, *Trochopella* is a synonym of *Trochopus.* With these changes the subfamily Trochopodinae, as presently understood, contains the following genera: *Allomegalocotyla* Yamaguti, 1963, *Macrophyllida* Johnston, 1923, *Megalocotyle* Folda, 1928, *Pseudobenedenia* Johnston, 1931, *Pseudomegalocotyla* Yamaguti, 1963, *Sprostonia* Bychowsky, 1957, and *Trochopus* Diesing, 1850.

Genus *Pseudobenedenia* Johnston, 1931

Diagnosis: Trochopodinae. Prohaptor consisting of head organs (or glandular areas) and a pair of ventrolateral suckers. Posthaptor a concavo-convex, circular disc, divided by septa into one central depression and 6 (*P. nototheniae* Johnston, 1931) or 7 peripheral depressions; armed with 3 pairs of anchors and 14 marginal hooks. Crura weakly or strongly branched. Testes two, usually juxtaposed (may range from juxtaposed to tandem position, as in *P. shorti* n. sp.). Cirrus complex consisting of muscular cirrus, prostate reservoir, and seminal vesicle in cirrus pouch. Vaginal aperture situated slightly to left of midline, near anterior border of vitelline reservoir. Eyespots present or absent.

Discussion: The modified diagnosis of the genus *Pseudobenedenia* given by Dollfus and Euzet (1964) is generally correct. Our specimens of *P. nototheniae* Johnston, 1931 apparently lack the seventh (anteriormost) septum, but due to the obscure septation in some capsalids, this septum may exist. Extensive collections now being made in Antarctica may settle this question.

Pseudobenedenia shorti new species
Figs. 1–10

Hosts: Trematomus bernacchii Boulenger, *T. hasoni* Boulenger, and *T. centronotus* Regan; family Nototheniidae. *Rhigophila dearborni* DeWitt (see below.); family Zoarcidae.

Location: Gills.

Localities: Trematomus bernacchii from stations M-SA, M-M, M-H, W-C, W-G, W-H, W-I, W-J, W-L, W-M, W-O, W-P, W-R, W-S, and W-AO. *T. hansoni* from stations M-SC, M-SA, M-M, M-H, W-K, W-L, W-Q, and W-S. *T. centronotus* from stations M-H and W-S, and *Trematomus* sp. from station W-BA. *Rhigophila dearborni* from station M-H.

Number Examined and Studied: 1,183.

Holotype: USNM Helm. Coll. No. 70956.

Paratypes: USNM Helm. Coll. No. 70957 (4 specimens).

Description of Adult: Body elongate, cylindrical, (20) 2,150 (1,550–2,520), S = 240, SE = 54, CL = 113 long by (20) 590 (450–710), S = 84, SE = 19, CL = 40 wide; cuticle fairly thin and smooth. Prohaptor consisting of head organs connected by ducts to cephalic glands and a pair of ventrolateral, muscular suckers, (20) 253 (148–347), S = 66.3, SE = 14.8, CL = 31.0 long by (20) 246 (159–322), S = 60.6, SE = 13.5, CL = 28.3 wide. Posthaptor a concavo-convex, circular disk, opening ventrally, (17) 620 (400–780), S = 116, SE = 28, CL = 59 long by (17) 700 (490–920), S = 127, SE = 31, CL = 66 wide, divided by septa into one central and 7 peripheral depressions; margin of posthaptor a strong muscular rim, surrounded by a delicate membrane; posthaptor armed with 3 pairs of anchors and 14 marginal hooks; posthaptor slightly pedunculated. Anteriormost anchors (19) 127 (90–

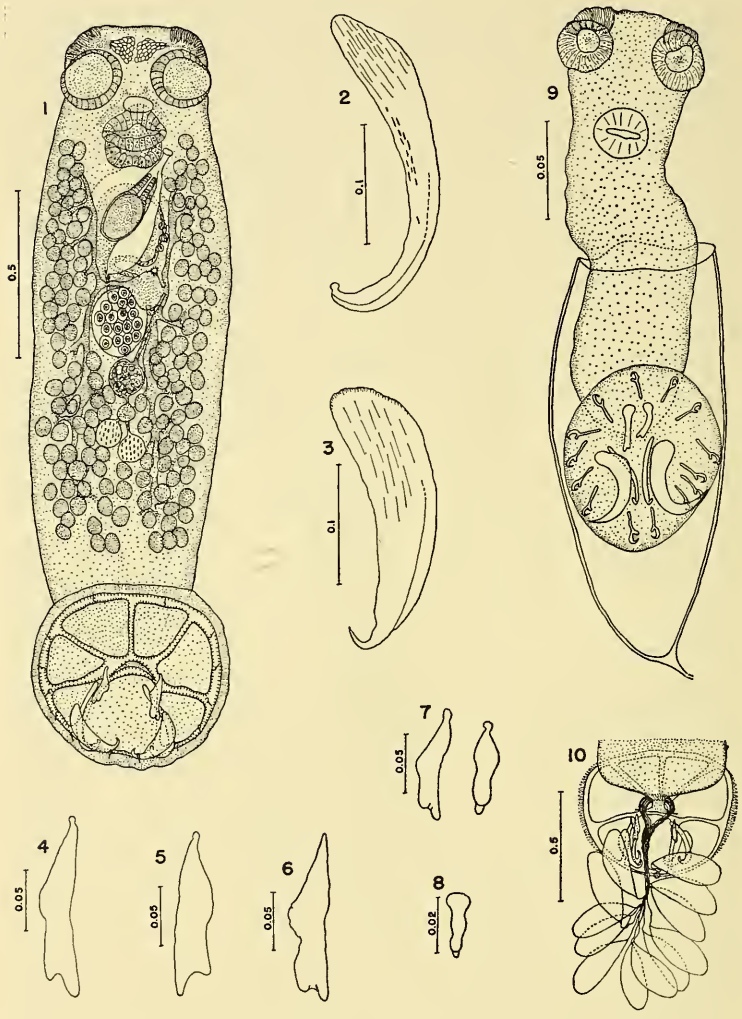
181), S= 23.1, SE = 5.3, CL = 11.1 long, with bifid base, strong shaft and rounded to pointed tips. (Tips of the anteriormost anchor pair are spatulate in the onchomiracidium, becoming less spatulate during early and late juvenile stages and more pointed in large adults, Figs. 4–8.) Middle anchors (18) 260 (199–308), S = 28.8, SE = 6.8, CL = 14.3 long; posteriormost anchors (16) 203 (148–247), S = 25.3, SE = 6.3, CL = 13.4 long. Marginal hooks (10) 14 (12–15), S = 0.8, SE = 0.25, CL = 0.6 long. Tissues of posthaptor with disclike sclerites.

Mouth ventral, subterminal, opening into muscular buccal funnel; rim of aperture serrated; wall of buccal funnel armed with conical papillae. Pharynx (18) 159 (129–198), S = 19.8, SE = 4.7, CL = 9.9 long by (18) 185 (156–216), S = 15.8, SE = 3.7, CL = 7.8 wide; esophagus short or non-existent. Gut bifurcated; crura weakly branched and apparently not confluent posteriorly.

Testes two, ranging from juxtaposed to tandem position, (12) 103 (87–122), S = 11.3, SE = 3.3, CL = 7.3 long by (12) 92 (83–118), S = 4.7, SE = 1.4, CL = 3.1 wide. Vasa efferentia anastomosing in midline to form vas deferens which proceeds anteriorly for a short distance prior to dilating immediately behind ovary; then passing around left side of ovary, crossing to right side of body and back to left side, and finally forming numerous loops before entering cirrus pouch. Cirrus complex consisting of muscular cirrus, prostate reservoir, and seminal vesicle in cirrus pouch; cirrus pouch (10) 272 (216–315), S = 39.4, SE = 12.5, CL = 28.3 long. Glands of Goto not observed. Cirrus and uterus opening to outside via common genital pore, located along left side of pharynx.

Ovary (13) 139 (92–231), S = 38.6, SE = 10.7, CL = 23.3 long by (13) 119 (76–185), S = 35.3, SE = 9.8, CL = 21.3 wide; oviduct convoluted, proceeding anteriorly to ootype. Ootype relatively large, apparently surrounded by Mehlis' glands; uterus extending diagonally from ootype to genital atrium. Vaginal opening small, located slightly to left of midline, near anterior border of vitelline reservoir; short vaginal duct proceeding into vitelline reservoir. Vitellaria follicular, somewhat large; transverse vitelloducts fusing medially to form vitelline reservoir. Eggs fusiform, (10) 303 (277–310), S = 9.7, SE = 3.1, CL = 7.0 long by (10) 114 (106–122), S = 5.7, SE = 1.8, CL = 4.1 wide (measurement exclusive of filament), with a long filament at one pole. (The filaments of the eggs are wrapped around the peduncle, which is behind the posthaptor in a standard ventral view, Fig. 10. This unusual habit has also been noted in *Ancyrocotyle vallei* by Parona and Perugia in 1895 and Parona and Monticelli in 1903.) Brain dorsal to oral aperture; eyespots absent.

Description of Onchomiracidium (Fig. 9): Body elongate, cylindrical, (2) 270 (252–288) long. Prohaptor with a pair of ventrolateral suckers and head organs. Posthaptor well defined, circular, armed with three pairs of anchors and 14 marginal hooks; anteriormost anchors (10) 23 (21–27) long, with spatulate tips wider than shaft or bifid roots; marginal



FIGURES 1–10. *Pseudobenedenia shorti* n. sp. 1, Whole mount, ventral view. 2, Middle anchor. 3, Posteriormost anchors. 4–6, Anteriormost anchors. 7, Anteriormost anchor from late juvenile (showing two different views). 8, Anteriormost anchor from early juvenile. 9, Onchomiracidium emerging from egg. 10, Showing filaments of eggs wrapped around peduncle. (Scales are in millimeters.)

hooks (10) 14 (13–16) long, without accessory sclerotized processes. Pharynx located in anterior ¼ of body proper; gut not observed. Eyespots and cilia absent.

Etymology: This species is named in honor of Dr. Robert B. Short.

Discussion: Pseudobenedenia shorti n. sp. can be distinguished from *P. nototheniae,* the type species, by: (1) general body shape; (2) shape of the posteriormost anchors; and (3) smaller prohaptoral suckers, posthaptor, pharynx, and testes.

Though we have indicated *Rhigophila dearborni* as a host of this species it is likely that the record on which it is based is erroneous. The single set of gills from which the worms were taken were separated from the main body of the specimen after collection, but before examination, and given a number. Much later a carcass bearing the matching number was identified as *R. dearborni* by Dr. Hugh DeWitt, then of the University of Southern California at Los Angeles.

We believe that this is an erroneous host record because: (1) *P. shorti* occurred on only one *Rhigophila dearborni* specimen though 101 of these fish were collected and examined in all, (2) a copepod, *Clavellodes intermedius* (Quidor, 1906) Wilson, 1915, which Zwerner (1966) believes to be specific for nototheniid fishes, was also collected from this particular host, and (3) none of the other monogeneids or copepods regularly occurring on *R. dearborni* were present on this specimen. If this single record is eliminated, *P. shorti* has been reported only from the several species of the genus *Trematomus* listed above.

Because the host record under discussion cannot be more positively challenged and we do not wish to reinforce our own notions of host-specificity by eliminating the record, it remains. It is hoped that later collections will support our conclusions that *Pseudobenedenia shorti* occurs only on species of the genus *Trematomus.*

Pseudobenedenia nototheniae Johnston, 1931

Host: Trematomus bernacchii Boulenger; family Nototheniidae.

Location: Skin.

Localities: Stations M-M and M-SA.

Previously Reported Hosts and Localities: Notothenia colbecki from Antipodes Island (Johnston, 1931) and from the Island of Auckland (see Dollfus and Euzet, 1964, p. 1, footnote 1). *N. macrocephala* (= *N. angustata*) from Antipodes Island and Macquarie Island (Johnston, 1931). *N. rossi* collected in the Kerguelens (Dollfus and Euzet, 1964).

Number Examined and Studied: One adult; four juveniles.

Discussion: Examination of the one adult specimen and four immature specimens from the skin of *Trematomus bernacchii* revealed that they are probably conspecific with *Pseudobenedenia nototheniae* Johnston, 1931.

Careful studies of the posthaptors of all worms failed to reveal the anteriormost septum which was described by Dollfus and Euzet (1964) but not by Johnston (1931). Additional specimens are needed for study

before we can challenge the description of Dollfus and Euzet in this regard. More extensive collections are now being made in Antarctica and a final decision on this matter may be available for inclusion in a later work.

Pseudobenedenia sp.

Host: *Trematomus borchgrevinki* Boulenger; family Nototheniidae.
Location: Gills.
Locality: Station M-H.
Number Studied: 253.

Discussion: The 253 juvenile specimens of an unidentified capsalid recovered from *T. borchgrevinki* are tentatively assigned to the genus *Pseudobenedenia* because of the glandular regions anterior to the prohaptoral suckers and the similarities of the anchors to those of *P. shorti*. *Pseudobenedenia* sp. differs from the juveniles of *P. shorti* in the following respects: (1) pharynx of juvenile specimens larger than that of the juveniles (or adults) of *P. shorti*, (2) presence of two eyespots (eyespots were absent in all stages of development in *P. shorti*), and (3) a slight difference in the relative lengths of the roots of the anteriormost anchors.

Because of these differences we are convinced that this population represents a species unknown to science. However, since all of the worms are early juveniles whose anatomical features are not developed sufficiently to permit more positive identification, confirmation of this thesis must await acquisition of adult specimens.

Literature Cited

Bychowsky, B. E. 1957. Monogenetic trematodes, their systematics and phylogeny. [in Russian] Izdanie Akad. Nauk USSR, Moskva-Leningrad, 509 p. (English Translation from the Russian by P. C. Oustinoff, edited by W. J. Hargis, Jr., 627 p. American Institute of Biological Sciences, Washington, D. C., 1961.)

Dillon, W. A., and W. J. Hargis, Jr. 1965. Monogenetic trematodes from the southern Pacific Ocean, 1. Monopisthocotyleids from New Zealand fishes, p. 229–249. *In* Biology of the Antarctic Seas II, Antarctic Res. Ser., 5.

Dollfus, R. Ph., and L. Euzet. 1964. Complement a la description de *Pseudobenedenia notothenidae* T. H. Johnston, 1931 (Trematoda Monogenea) parasite d'un teleosteen du genre *Notothenia* Richardson des Kerguelen. Bull. Mus. Nat. Hist. Natur. 2e Ser., 36 (6): 849–857.

Hargis, W. J., Jr., and W. A. Dillon. Helminth parasites of Antarctic vertebrates, II, Monogenetic trematodes from Antarctic fishes: The superfamily Gyrodactyloidea Johnston and Tiegs, 1922. (In press.)

Johnston, T. H. 1931. New trematodes from the subantarctic and Antarctic. Aust. J. Exp. Biol. Med. Sci., 8: 91–98.

Parona, C., and F. S. Monticelli. 1903. Sul genere *Ancyrocotyle* (n.g.). Arch. Parasitol., 7 (1): 117–121.

Parona, C., and A. Perucia. 1895. Supra due nuove specie di Trematodi ectoparassiti di pesci marini. Boll. Mus. Zool. Anat. Comp. R. Univ. Genova, 31: 1–4.

Yamaguti, S. 1963. Systema Helminthum. IV. Monogenea and Aspidocotylea. John Wiley & Sons, New York–London, 699 p.

Zwerner, D. E. 1966. Parasitic copepods of some Antarctic and New Zealand fishes. (Unpublished Master's Thesis, School of Marine Science, College of William and Mary, Virginia Institute of Marine Science, Gloucester Point, Virginia, U. S. A.)